RADIONUCLIDE SPECIATION IN SEDIMENTS OF THE YENISEI RIVER

BOLSUNOVSKY A.
Institute of Biophysics Siberian Branch Russian Academy of Sciences, Krasnoyarsk, 660036 Russia, *radecol@ibp.ru*

Releases from the nuclear facility Mining-and-Chemical Combine (MCC) located at Zheleznogorsk have contributed to the radionuclide contamination of the Yenisei River since its operation commenced in 1958. The aim of this study was to assess the activity concentrations of artificial radionuclides and the strength of their binding in sediments of the Yenisei River. Investigations of the Yenisei River sediment samples revealed the presence of artificial radionuclides typical of the MCC radioactive discharge: isotopes of europium, caesium, ^{60}Co, ^{90}Sr and transuranium elements (Pu, Am, Cm and Np isotopes). The vertical distribution of radionuclides in sediment is very complex and there are some concentration minimums and maximums due to different velocities of radionuclides released by the MCC and variations in global fallouts. Investigations of the Yenisei River sediment samples revealed the local anomalous spots with high activity concentrations of transuranium elements, which were 100 times higher than their global levels. Concentrations of artificial radionuclides in sediment layers remain relatively high as far as 250 km downstream of the MCC. Sequential extraction techniques are the most common method of studying radionuclide speciation in soils and sediments. Sequential extraction technique proposed by Tessier was used to investigate binding of radionuclides to sediment of the Yenisei River. Chemical fractionation of sediment samples collected near the MCC showed that the amounts of extracted ^{90}Sr, ^{152}Eu and ^{241}Am were the largest (60-80% of initial activity), then followed ^{60}Co (30%), ^{238,239,240}Pu (15-30%), and, last, ^{137}Cs (5-15%). The distribution of ^{238}U among chemical fractions of sediments was similar to that of ^{60}Co and ^{238,239,240}Pu: 30-40% of ^{238}U initial activity was extracted. The largest amounts of the radionuclides were extracted from such fractions as organics, sesquioxides and hydroxides. In a few samples, ^{241}Am was present in the unextractable form, which may be accounted for by the presence of microparticles of the reactor fuel. The results of sequential extraction of sediment samples showed differences in radionuclide concentrations in extracted forms between the lower and the upper sediment layers of the core. These data suggest that the physicochemical processes occurring in the lower sediment layers change the properties of the sediments and their adsorption power. The amounts of the radionuclides released from different fractions varied depending on the distance downstream of the MCC. Previously, similar studies were only performed for 1 or 2 radionuclides. This study is the first to assess potential environmental availability of a large number of radionuclides (including transuranic ones) in sediments located at different distances downstream of the MCC discharge site, taking into account different residence times of

radionuclides in sediment layers (based on layer dating).